Device for Rotary Machining of Rotors

The invention relates to a device for rotary machining of rotors on machining surfaces facing radially inward according to the preamble of Patent Claim 1.

GB-A-2 240 735 discloses a device for rotary machining of stators of gas turbine engines, said device being provided in particular for machining a shroud liner on the fan housing. This device is designed as a portable machining station having an arm (26) that extends radially, can be coupled to the low-pressure shaft of the engine and can be driven by an electric motor, the lathe tool sitting on the radially outer end of the arm. The lathe tool/cutting tool is arranged so it is adjustable, i.e., movable axially and radially in relation to the arm (26) on carriage-like mounts (48, 60). During the axial feed movement, the radial position is preferably controlled via a rocker cam (88), so that the proper contour of the shroud liner is "automatically" obtained, this contour being essentially in the form of a circular cylinder with minor variations in diameter. The advantage of this device may be regarded as the fact that large, sensitive modular units such as engines can be machined in their proper installed position, taking into account the loads and deformation stresses occurring in this position, so that better dimensional stability during operation can be achieved. The coupling and startup of operation of the device require relatively large inside cross-sections that are open at one end axially, such as a fan housing that is open at the front without any undercuts and/or other constrictions. This device is not suitable for inside machining of rotors composed of several disks having deep undercuts and/or chambers.

Rotors of gas turbines, especially rotors of high-pressure compressors of aircraft engines, are usually formed by several rotor disks arranged axially in succession, whereby the rotor disks are either bolted together or welded together. If the rotor disks are welded, welds formed on radially interior surfaces and radially exterior surfaces must be reworked to prevent notching. Since it is difficult to gain access to the radially interior surfaces of rotors, machining of welds on radially interior surfaces is more problematic than machining of welds on radially exterior surfaces.

In the course of the optimization of gas turbines, especially optimization of aircraft engines, higher and higher rotational speeds of the rotors are necessary. The load to be sustained by the rotors is also increased. As a rule, the hub bores inside the rotors are smaller, the higher the load on the rotors. It follows from this that the radial depth of chambers arranged between interconnected rotor disks increases. For example, if the radial depth of the chambers arranged between the interconnected rotor disks is greater than the diameter of the hub bore, special devices and/or tools are necessary for machining, namely for rotary machining, of the radially interior machining surfaces extending between the interconnected rotor disks.

Referring to prior art, devices and/or tools for rotary machining of rotors on radially interior machining surfaces taking into account the problems outlined above have been known. However, the devices and/or tools for rotary machining known from prior art are no longer suitable in particular if the width of the rotor disks in the hub area also increases in addition to the progressively increasing radial depth of the chambers extending between interconnected rotor disks, i.e., if the axial distance between two rotor disks is reduced in the hub area. In this case, it is impossible to insert the devices and/or tools known from prior art for rotary machining into the rotors to be machined and/or to perform a rotary machining on the radially interior machining surfaces of the rotor.

Against this background, the object of the present invention is to create a novel device for the internal machining of components.

This object is achieved in that the device mentioned in the beginning is improved upon by the features of the characterizing portion of Patent Claim 1. According to this invention, the drill rod has a projection extending essentially radially, this projection being couplable with the tool mount extending essentially radially, whereby the radial dimensions of the projection of the bore rod and of the tool mount are adapted to the dimensions of a hub bore of the component to be machined such that the drill rod and the tool mount can be inserted in the uncoupled state into the hub bore and in the coupled state the lathe tool mounted in the tool mount can be brought up to the radially interior machining surface of the component.

The lathe tool, together with its holder, can be pivoted primarily in the axial direction, for which purpose a drive shaft is installed in the drill rod and a gear is installed in the projection of the drill rod and in the tool mount.

The present invention proposes a device for rotary machining of rotors on radially interior machining surfaces of the rotors, said device even permitting reliable and secure machining of the radially interior machining surfaces of the rotors if, on the one hand, the diameter of the hub bores in the rotors to be machined is smaller and thus the radial extent of the chambers located between two rotor disks inside the rotors to be machined is greater, and if, on the other hand, the axial distance in the hub area, in particular between neighboring rotor disks which border chambers extending essentially in the radial direction, becomes smaller.

Preferred developments of the present invention are obvious from the subclaims and the following description. Exemplary embodiments of the invention are explained in greater detail below on the basis of the drawings without being limited thereto. They show in:

Fig. 1 a schematic illustration of an inventive device for rotary machining of rotors on radially interior machining surfaces of the components, in plan view and in side view;